



Updates to update-all-versions p2z branch

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Fit failures

- Current smearing value is 10^{-5} (where units depend on parameter).
- No physical meaning in smearing values, goal is just to avoid having identical results
- Reducing smearing by factor 10-100x eliminates nans and fit failures
 - with 10^{-6} we only have one residual failure when using icc, which goes away when using “-fp-model strict” in compilation
- I'd be in favor of reducing smearing and getting rid of failures so that we do not need to discuss them in the paper

More uniform output reporting

- Using same conditions and same floating point precision helps getting same output reports

alpaka

1114 - if (isnan(x_)	1118 + if (std::isfinite(x_)==false
1115 - isnan(y_)	1119 + std::isfinite(y_)==false
1116 - isnan(z_)	1120 + std::isfinite(z_)==false
1117 - isnan(pt_)	1121 + std::isfinite(pt_)==false
1118 - isnan(phi_)	1122 + std::isfinite(phi_)==false
1119 - isnan(theta_)	1123 + std::isfinite(theta_)==false
1120) {	1124) {
1121 nnans++;	1125 nnans++;
1122 continue;	1126 continue;
1123 }	1127 }
1124 if (fabs((x_-hx_)/hx_)>1.	1128 if (fabs((x_-hx_)/hx_)>1.
1125 fabs((y_-hy_)/hy_)>1.	1129 fabs((y_-hy_)/hy_)>1.
1126 fabs((z_-hz_)/hz_)>1.	1130 fabs((z_-hz_)/hz_)>1.
1127 - fabs((pt_-12.)/12.)>1.	1131 + fabs((pt_-12.)/12.)>1.
1128 -) {	1132 + fabs((phi_-1.3)/1.3)>1.
1129 - nfail++;	1133 + fabs((theta_-2.8)/2.8)>1.
1130 - continue;	1134 +) {
	1135 + nfail++;
	1136 + continue;

TBB

745 int nnans = 0, nfail = 0, ngood = 0;	784 int nnans = 0, nfail = 0, ngood = 0;
746 - float avgx = 0, avgy = 0, avgz = 0;	785 + double avgx = 0, avgy = 0, avgz = 0;
747 - float avgpt = 0, avgphi = 0, avgtheta = 0;	786 + double avgpt = 0, avgphi = 0, avgtheta = 0;
748 - float avgdx = 0, avgdy = 0, avgdz = 0;	787 + double avgdx = 0, avgdy = 0, avgdz = 0;
749 for (size_t ie=0;ie<nrvts;++ie) {	788 for (size_t ie=0;ie<nrvts;++ie) {
750 for (size_t it=0;it<ntrks;++it) {	789 for (size_t it=0;it<ntrks;++it) {
751 - float x_ = x(outtrk,ie,it);	790 + double x_ = x(outtrk,ie,it);
752 - float y_ = y(outtrk,ie,it);	791 + double y_ = y(outtrk,ie,it);
753 - float z_ = z(outtrk,ie,it);	792 + double z_ = z(outtrk,ie,it);
754 - float pt_ = 1./ipt(outtrk,ie,it);	793 + //printf("e=%li t=%li z=%10f \n", ie, it, z_);
755 - float phi_ = phi(outtrk,ie,it);	794 + double pt_ = 1./ipt(outtrk,ie,it);
756 - float theta_ = theta(outtrk,ie,it);	795 + double phi_ = phi(outtrk,ie,it);
757 - float hx_ = inputhits[nlayer-1].pos[0];	796 + double theta_ = theta(outtrk,ie,it);
758 - float hy_ = inputhits[nlayer-1].pos[1];	797 + double hx_ = inputhits[nlayer-1].pos[0];
759 - float hz_ = inputhits[nlayer-1].pos[2];	798 + double hy_ = inputhits[nlayer-1].pos[1];
760 - float hr_ = sqrtf(hx_*hx_ + hy_*hy_);	799 + double hz_ = inputhits[nlayer-1].pos[2];
	800 + double hr_ = sqrtf(hx_*hx_ + hy_*hy_);
761 if (std::isfinite(x_)==false	801 if (std::isfinite(x_)==false
762 std::isfinite(y_)==false	802 std::isfinite(y_)==false

Output results - GCC

TBB

```
(base) cerati@apollo:~/p2z-tests$ tail -17 logs/propagate_gcc_tbb.log
produce nevts=100 ntrks=9600 smearing by=1.0e-07
NITER=10
done preparing!
setup time time=4.409000 (s)
done ntracks=9600000 tot time=0.554024 (s) time/trk=5.771083e-08 (s)
formatted 10 100 9600 32 300 0.554024 0 4.409000 64
track x avg=6.443559 std/avg=0.000039
track y avg=24.394711 std/avg=0.000039
track z avg=-80.523956 std/avg=0.000000
track dx/x avg=-0.136059 std=0.000045
track dy/y avg=-0.136419 std=0.000044
track dz/z avg=0.000000 std=0.000000
track pt avg=12.328098
track phi avg=1.325565
track theta avg=2.820840
number of tracks with nans=0
number of tracks failed=0
```

OMP

```
(base) cerati@apollo:~/p2z-tests$ tail -17 logs/propagate_gcc_omp.log
produce nevts=100 ntrks=9600 smearing by=1.0e-07
NITER=10
done preparing!
setup time time=4.401000 (s)
done ntracks=9600000 tot time=0.766436 (s) time/trk=7.983708e-08 (s)
formatted 10 100 9600 32 300 0.766436 0 4.401000 64
track x avg=6.443559 std/avg=0.000039
track y avg=24.394711 std/avg=0.000039
track z avg=-80.523956 std/avg=0.000000
track dx/x avg=-0.136059 std=0.000045
track dy/y avg=-0.136419 std=0.000044
track dz/z avg=0.000000 std=0.000000
track pt avg=12.328098
track phi avg=1.325565
track theta avg=2.820840
number of tracks with nans=0
number of tracks failed=0
```

alpaka

```
(base) cerati@apollo:~/p2z-tests$ tail -17 logs/propagate_gcc_alpaka.log
Size of struct struct MPHIT hit[] = 691200000
Warming up
Launching
setup time time=6.189000 (s)
done ntracks=9600000 tot time=3.128342 (s) time/trk=3.258690e-07 (s)
formatted 10 100 9600 32 300 3.128342 0 6.189000 1
track x avg=6.443559 std/avg=0.000039
track y avg=24.394711 std/avg=0.000039
track z avg=-80.523956 std/avg=0.000000
track dx/x avg=-0.136059 std=0.000045
track dy/y avg=-0.136419 std=0.000044
track dz/z avg=0.000000 std=0.000000
track pt avg=12.328098
track phi avg=1.325565
track theta avg=2.820840
number of tracks with nans=0
number of tracks failed=0
```

kokkos

```
(base) cerati@apollo:~/p2z-tests$ tail -17 logs/propagate_gcc_kokkosv3.log
Size of struct MPTRK trk[] = 107520000
Size of struct MPTRK outtrk[] = 107520000
Size of struct struct MPHIT hit[] = 691200000
setup time time=6.183000 (s)
done ntracks=9600000 tot time=1.091332 (s) time/trk=1.136804e-07 (s)
formatted 10 100 9600 32 300 1.091332 0 6.183000 -1
track x avg=6.443559 std/avg=0.000039
track y avg=24.394712 std/avg=0.000039
track z avg=-80.523956 std/avg=0.000000
track dx/x avg=-0.136059 std=0.000045
track dy/y avg=-0.136419 std=0.000044
track dz/z avg=0.000000 std=0.000000
track pt avg=12.328098
track phi avg=1.325565
track theta avg=2.820840
number of tracks with nans=0
number of tracks failed=0
```


Output results - ICC

TBB

```
(base) cerati@apollo:~/p2z-tests$ tail -17 logs/propagate_icc_tbb.log
produce nevts=100 ntrks=9600 smearing by=1.0e-07
NITER=10
done preparing!
setup time time=4.085000 (s)
done ntracks=9600000 tot time=0.215275 (s) time/trk=2.242448e-08 (s)
formatted 10 100 9600 32 300 0.215275 0 4.085000 64
track x avg=6.443813 std/avg=0.000040
track y avg=24.395778 std/avg=0.000039
track z avg=-80.523956 std/avg=0.000000
track dx/x avg=-0.136014 std=0.000045
track dy/y avg=-0.136370 std=0.000045
track dz/z avg=0.000000 std=0.000000
track pt avg=12.329988
track phi avg=1.325591
track theta avg=2.820849
number of tracks with nans=0
number of tracks failed=0
```

OMP

```
(base) cerati@apollo:~/p2z-tests$ tail -17 logs/propagate_icc_omp.log
produce nevts=100 ntrks=9600 smearing by=1.0e-07
NITER=10
done preparing!
setup time time=4.042000 (s)
done ntracks=9600000 tot time=0.349019 (s) time/trk=3.635615e-08 (s)
formatted 10 100 9600 32 300 0.349019 0 4.042000 64
track x avg=6.443813 std/avg=0.000040
track y avg=24.395778 std/avg=0.000039
track z avg=-80.523956 std/avg=0.000000
track dx/x avg=-0.136014 std=0.000045
track dy/y avg=-0.136370 std=0.000045
track dz/z avg=0.000000 std=0.000000
track pt avg=12.329988
track phi avg=1.325591
track theta avg=2.820849
number of tracks with nans=0
number of tracks failed=0
```

TBB
strict fp

```
(base) cerati@apollo:~/p2z-tests$ tail -17 logs/propagate_icc-strict_tbb.log
produce nevts=100 ntrks=9600 smearing by=1.0e-07
NITER=10
done preparing!
setup time time=11.093000 (s)
done ntracks=9600000 tot time=0.613150 (s) time/trk=6.386979e-08 (s)
formatted 10 100 9600 32 300 0.613150 0 11.093000 64
track x avg=6.443561 std/avg=0.000039
track y avg=24.394716 std/avg=0.000039
track z avg=-80.523956 std/avg=0.000000
track dx/x avg=-0.136059 std=0.000045
track dy/y avg=-0.136419 std=0.000044
track dz/z avg=0.000000 std=0.000000
track pt avg=12.328070
track phi avg=1.325565
track theta avg=2.820840
number of tracks with nans=0
number of tracks failed=0
```

TBB
GCC

```
(base) cerati@apollo:~/p2z-tests$ tail -17 logs/propagate_gcc_tbb.log
produce nevts=100 ntrks=9600 smearing by=1.0e-07
NITER=10
done preparing!
setup time time=4.409000 (s)
done ntracks=9600000 tot time=0.554024 (s) time/trk=5.771083e-08 (s)
formatted 10 100 9600 32 300 0.554024 0 4.409000 64
track x avg=6.443559 std/avg=0.000039
track y avg=24.394711 std/avg=0.000039
track z avg=-80.523956 std/avg=0.000000
track dx/x avg=-0.136059 std=0.000045
track dy/y avg=-0.136419 std=0.000044
track dz/z avg=0.000000 std=0.000000
track pt avg=12.328098
track phi avg=1.325565
track theta avg=2.820840
number of tracks with nans=0
number of tracks failed=0
```

Using “-fp-model strict” makes ICC output more similar to GCC, but of course has impact on timing. Bottom line message for the paper is that differences are due to floating point precision and that we should clarify what configuration we use for compilation.

To-do

- Make sure thread configurations are the same or at least optimized for each version
- Re-run timing?
- Check if GPU versions (some of which also run on CPU) need to be changed